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COMPUTERIZED PROJECT INDEXING AND RETRIEVAL

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COMPUTERIZED PROJECT INDEXING AND RETRIEVAL

Thomas J. Thiel¹

SUMMARY

Research in Agricultural Research Service (ARS) is documented with a formal project system; however, retrieving project information can be time consuming and difficult. The North Central Region's Program Planning and Review (PPR) staff needed a system that was effective, current, inexpensive, and easily maintained. Computerized indexing met all these requirements and provided many additional benefits.

A commercially available computerized information processing system, TRIAL,² capable of editing, indexing, and searching of textual and numeric data was used to assemble keyword indexes of research activities and Current Research Information System (CRIS) work units. This operation is essentially a sophisticated cross-index card file and is not dependent upon CRIS projects per se; any project system can be handled.

These indexes arrange project data into listings according to information contained in the project

entry. Examples include (1) work under a research activity, at a location, or by investigators; (2) extramural and PL 480 research, (3) work coordinated by the National Program Staff (NPS), Program Analysis and Coordination Staff (PACS) or Technical Advisors (TA), (4) linking-data for financial plans, (5) work by important terms in the title and associated keywords, and others.

The TRIAL system provides a printed copy for each staff member and it is easy to use and maintain by the nontechnical PPR staff. It has become a primary information system to the PPR unit and has great potential for expansion. There is no conflict with or significant duplication of CRIS; rather, it is a natural extension of that system.

This publication illustrates the various types of indexes the system produces and their practical application in the PPR operations. A more detailed description of the system's mechanics is provided in the appendix.

INTRODUCTION

The research program in the Agricultural Research Service is documented with a formal hierarchical project structure of (in increasing specificity) missions, goals, programs, research activities (RA's), work reporting units (WRU's), and CRIS work units (CWU's). The RA, WRU, and CWU are the most functional for program information, documentation, reporting and planning.

The problem faced by the PPR staff was how to file and retrieve program documents by various kinds or types of data. Some basic project data categories are:

1. In-house Projects
 - CRIS work unit number.
 - Title and keywords.
 - Location of work.
 - Research Activity numbers.
 - Personnel (Scientists, NPS, PACS, TA).
 - Activity, commodity, field of science, RPA, Codes.
 - Old project numbers.
2. Extramural Projects
 - All in-house plus.
 - Department Representative (ADODR).
 - Location of work.
 - Location of ADODR.
 - Contract, grant, cooperative agreement number.

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²TRIAL is an acronym for Techniques for Retrieving Information from Abstracts of Literature. It is available from the Vogelback Computing Center, Northwestern University, Evanston, Ill. IBM 360 and 370 and CDC 6000 versions are available.

By having projects indexed on these categories, the PPR staff can quickly retrieve projects in response to specific questions. These indexes are also useful for general assembly of projects by locations, activities, and similar indexes.

APPROACH

Standard manually maintained cross-index card files require excessive file maintenance to provide the degree of cross reference needed. Needle-sort systems offered some potential, but these become cumbersome with a large number of entries. Also, neither of these systems offer reproduction capabilities.

On-line computer searching would, of course, be ideal. It could provide more current information and greater flexibility in combining projects by the

various data components. But such a system requires expensive on-line computer components; to provide the same degree of usefulness, each staff member would require immediate access to a terminal.

Computer-prepared indexes were the best compromise between the manual and on-line systems. Many computer indexing systems are available at minor initial cost, do not require knowledge of computer programming, and have enormous capabilities for indexing and retrieving.

TRIAL SYSTEM

PPR selected the TRIAL system developed at Northwestern University because it is readily available, has a good operational record,^{3 4} utilizes standard IBM KWIC format,⁵ and has great indexing and searching capabilities. Many similar systems are available either on tape or on the operating system of many computing centers.

The TRIAL information processing system performs editing, indexing, and retrieval of textual and numeric information. It allows for the creation and maintenance of a master file, which can then be indexed on keywords. TRIAL also provides for computer retrieval and printout of entries that satisfy a user search command. The system is programmed to permit any combination of indexes or searches with a single computer run.

The TRIAL system is adaptable to many diverse applications in information retrieval. Although the system was designed primarily for abstracts of literature, it is suitable for many other such applications as the project system under discussion here or for many other kinds of files.

File Structure: File structure refers to the format of the material entered in a file or data base and is primarily a function of the material to be entered and of the retrieval operations the user wishes to perform. TRIAL file structure consists of entries and levels. An entry is defined as all the

information about one element of the data file. In this application an entry consists of all the data about one CWU or RA. Each entry in the TRIAL file structure is divided into subcomponents or levels. Nine levels are permitted by TRIAL; in this application only four levels are used. They are:

<u>Level</u>	<u>Description</u>
1	Investigator(s), NPS, PACS, and TA's.
2	Title and Keywords.
3	CWU and RA Nos., termination date; and for extramural projects, the location of work, ADODR, and agreement number.
4	Dollar amounts, activity, commodity, field of science and RPA data.

The remaining five levels are available for possible future applications.

Indexing: TRIAL can prepare three distinct types of indexes: Keyword-out-of-context (KWOC), keyword-in-context (KWIC), and a short-form author or investigator index. Three types of keywords are recognized by the index routines: (1) all words in the entry, (2) a list of user-supplied keywords, or (3) all words in the entry except a list of user-supplied stopwords that are trivial for information retrieval purposes. In this context any string of letters or numbers, or both, separated by a space or a comma constitute a keyword. Hence numbers are also keywords. Maximum keyword length is 20 characters.

Operating Procedure: Although normal TRIAL operations place all the data on a tape, which can be saved and used in subsequent TRIAL runs, PPR maintains the system entirely on data cards. A project is entered into the system when the project is approved in the regional office. New projects are most frequently questioned.

³Janda, Kenneth. 1968. Information retrieval—application to political science. Bobbs Merrill Company, Inc., Indianapolis and New York.

⁴Thiel, T. J., R. H. Dowdy and W. E. Larson. 1971. Computerized information retrieval for soil and crop scientists. Agron. J. 63: 346-350.

⁵International Business Machines Corporation. 1962. Keyword-in-context (KWIC) indexing. IBM technical publication E20-8091-0, Technical Publications Department, White Plains, N.Y.

CROSSBREEDING) =.	EVALUATION AND UTILIZATION OF PITUITARY-ADRENAL FUNCTION IN IMMUNOCLOBULINS OF RASTRUCTURAL CHARACTERISTICS OF THE MICROBIOIDA OF MYCOSES OF STUDIES ON MYCOIC MASTITIS IN HIGH-PROTEIN PEANUT PRODUCTS FOR EXPORT AND IMPROVED BRASSICA CULTIVARS AS POTENTIAL PRODUCTION PRACTICES FOR ALASKA (BREEDING CRACKING HOST-PARASITE RELATIONS OF SOYBEAN COMPOSITION OF SOYBEANS (POUS PROTEINS PHYTOPHTHORA NG AND GENETICS OF SOYBEANS (CUILS PROTEINS LIPIDS PATHOLOGY OF SUNFLOWER (GILSEUS GERM-PLASM RUST HUM DISEASES AND THEIR CONTROL (SAUT CHARCOAL-ROT UVAL WASTEWATER (NITROGEN SEWAGE PHOPHURUS METALS	DOMESTIC AND EXOTIC GERM PLASM IN SHEEP (BREEDING DOMESTIC ANIMAL AND PHYSIOPATHOLOGY OF SECRETORY D DOMESTIC ANIMALS =. DOMESTIC ANIMALS (ANIMAL-VIRUSES BACTERIA VIRUSES DOMESTIC ANIMALS (FUNGAL ASPERGILLOSIS) =. DOMESTIC ANIMALS WITH PARTICULAR REFERENCE TO ITS DOMESTIC MARKETS =. DOMESTIC SOURCES OF HIGH-ERUCIC OIL (ERUCIC-ACIO, DORMANCY EYE-DEPTH FROST- RESISTANCE LIGHT-QUALITY DUMNY-MILDEW (DISEASE-RESISTANCE BIOCHEMICAL-DIVER DUMNY-MILDEW) =. DUMNY-MILDEW) =. DUMNY-MILDEW) =. DUMNY-MILDEW) =. BREEDING, GENETICS, SORGE DRAINAGE MUNICIPAL-WASTE) =. DRAINAGE OF IRRIGATED AND NON-IRRIGATED SOILS FOR DRAINAGE PHOSPHORUS POLLUTION METALS =. DRAINAGE POLLUTION) =. DRAINAGE SYSTEMS FOR AGRICULTURAL LAND =. ORIED OENT CORN AND OF HIGH-LYSINE CORN (MILLING D DRUSOPHILA CYTOGENETICS MUSCLE-PHYSIOLOGY =. DRUGS - PLANTS, MONANTHUM, (RAN) =. CHEMOTAXON DRUG-PLANTS SOILS NARCOTICS PREDICTION PHYSIOLOGY DRY BEANS IN THE NORTH CENTRAL STATES (VIRUS-OISEA DRY MILLING OF ARTIFICIALLY ORIED DENT CORN AND OF DRYERS =. REDUCTION OF AIR POLLUTION CAUSED BY P DRYING (CORN) =. DRYING AIR-POLLUTION) =. DRYING AND STORAGE (CORN MOLDS MYCOTOXINS) =. DRYING CONDITIONING AND STORAGE ON FARMS (CORN) =. DRYING GRAIN (WRPS) =. DRYING MILLING GENOTYPES HEATING) =. DRYING WHEAT SORGHUM CORN) =. DRYLAND AND IRRIGATED SOILS OF THE NORTHERN GREAT DRYLAND CROPS IN THE NORTHERN GREAT PLAINS =. DRYSPLEOITHRIX TOXINS) =. EP DUCKS AND OTHER SPECIALITY FDWL =. DUCKS STERODIOS) =. ORN DUCKS) =. DUCKS OF STERILE MALE CALLOSBRUCHUS MACULATUS, A DUCKS OF STERILE MALE CALL OSORUCHUS MACULATUS, A	37021554000470123 32021120000120109 32021172000320144 32021172000120142 32021182000120149 7APLOD0000025P0012 14020 31021558000110104 36111002000160187 34081061000540152 33111061000430136 33111061000130133 36021546000160127 37071053000270167 309014693003ED034 36051228000160136 309014692002E0033 35021469000350109 12280 31021568000110119 33021204000130109 A22815 22815 A22922 22922 35081006000150147 302011568000110119 15000 34081570000340130 37071570000270162 34081570000140128 34081570000240129 37071570000570175 3102156000110164 37071570000470164 36051232000460150 36051232000260153 32021170000120134 37071570000470164 36021428000760122 32021176000120148 36021428000660121 A20614 20614 A22779 22779
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Figure 1.—Key-Word-in-Context (KWIC) Index of Projects. The keyword is to the right of the vertical space near the center of the page, and up to 100 characters of the title are written in a wrapped manner around the keyword; the user can evaluate the word in the context in which it was used. To the right of each listing are 17 characters of reference code. The first 12 signify where the project is filed or where it can be located in other indexes prepared with this computer run and the last five locate the entry in the data deck. Where only the latter five digits are given, such as in lines 7, 19, and 26, a Research Activity is indicated. In this example, the first keyword is "domestic" and the title is "Evaluation and utilization of domestic and exotic germplasm in sheep (breeding, crossbreeding)." The italicized terms are other words in the title that were indexed at other locations in this index.

MCCALLA T M	370514740000170139
MCCALLA T M	ELLIS J R
CHEMISTRY AND MICROBIOLOGY OF RUNOFF, SOIL PROFILES, AND GROUNDWATER FROM FEEDLOTS AND WASTE-DISPOSAL AREAS	3705-14740-001 14740 5T761D
GILBERTSON C B	NIEHABER J A
WASTE MANAGEMENT IN HOUSE AND OUTDOOR BEEF AND SWINE FEEDLOTS	3705-14740-002 14740 5T761D
ELLIOTT L F	MCCALLA T M
VOLATILE CHEMICALS, MICROORGANISMS, AND DUST IN THE ENVIRONMENT OF INDOOR AND OUTDOOR CONFINED BEEF AND SWINE UNITS (ODORS AMINES SULFHYDRILS FATTY-ACIDS GASES AMMONIA HYDROGEN-SULFIDE CARBON-DIOXIDE)	3705-14740-003 14740 5T7701
SWANSON N P	LINDERHAN C L
LIVESTOCK FEEDLOT HYDROLOGY AND FACILITIES FOR CONTROL AND UTILIZATION OF RUNOFF AND TRANSPORTED SOLIDS (GROUNDWATER ANIMAL-WASTES POLLUTION WATER-QUALITY EROSION)	3705-14740-004 14740 5T7701
MIELKE L N	SWANSON N P
SOIL-RELATED PHYSICAL PROPERTIES OF LIVESTOCK FEEDLOTS, RUNOFF STORAGE AND DISPOSAL AREAS (SOIL-STRUCTURE POLLUTION ANIMAL-WASTE GROUNDWATER)	3705-14740-005 14740 5T7701
MCCALLA T M	SCHUMAN G E
ASSESSMENT AND CONTROL OF POLLUTION OF SURFACE AND GROUND WATER BY FERTILIZERS (NUTRIENT-MOVEMENT WATERSHEDS EUTROPHICATION NITRATES SEDIMENTS PHOSPHATES NITROGEN)	3705-14830-DD1 14830 5T7411 9-SWC-027-DLI-3

Figure 2.—Key-Word-Out-of-Context (KWOC) Index on Investigator Names. Shown are the projects on which T. M. McCalla is an investigator. Note: The scientist is listed regardless of position on a project. Three levels of information were printed with this index: investigator, title, and project numbers.

TRIAL system runs on the entire file—RA's, and all in-house and extramural CWU's, both active and terminated—are obtained three or four times a year. Because of the magnitude of this run, a computer that has more than minimal capability (IBM 360/50, CDC 6400 or higher) should be used. Between major runs all additions to the file and all changes to existing entries are accumulated and run separately on a monthly basis.

Costs: One computer run that produced three indexes of about 1,400 projects took about 5 minutes of Central Processor Unit (CPU) time on an IBM 370/178. In another application, the author has used TRIAL to prepare an author and title index of 3,884 soil and water conservation research references on a CDC 6600 computer. This required 222 seconds on the (CPU) and cost a total of \$40 in 1974.

14740	INPS-YECK 3TA1-L SMITH MANAGEMENT OF ANIMAL WASTES TO PRODUCE USEFUL PRODUCTS AND FOR PREVENTING ENVIRONMENTAL POLLUTION 14740 PE-71-676 88-76 SWA 31021474000110133	14740 3TA3-MCCALLA SLONEKER J H CONTROLLED DEGRAADATION OF FEEDLOT WASTE TO FERTILIZER OR FEED. (JODR CORN SORGHUM) 3102-14740-001 14740 517505 9-N1-1-366 87000. A4830-100 C1400-080 C1500-020 F0112-050 F0790-050 R0901-100 31021474000210134	14740 FISCHER J R FACTORS AFFECTING LAGOON PERFORMANCE (LIVESTOCK-WASTE FEEDLOT-WASTES POLLUTION) 3102-14740-002 14740 517401 26300. A4830-100 C3000-100 F1920-080 F0214-020 R0901-100 35021474000150111
	JONES K W PREPARATION OF PROTEIN-ENRICHED FEED FROM FEEDLOT WASTES (CORN SORGHUM WASTE-UTILIZATION ANIMAL-WASTE) 3102-14740-002 14740 517405 9-N1-1-367 435000. A4830-100 C1400-090 C1500-010 F1527-100 R0901-100 31021474000310135		LARSON R E EVALUATION OF WASTE HANDLING SYSTEMS FOR HOUSED LARGE ANIMAL (THE NORTH CENTRAL REGION (POLLUTION OXIDATION CATTLE) 3502-14740-001 14740 517405 9-901-031-8613 TERMINATED***** 71400. A4830-100 C3100-100 F1920-100 R0901-100 37021474000170105
	ESKINS K SENSITIZED PHOTODEGRADATION OF ANIMAL WASTES (ANTHRA-QUINONE-2-SULFOGATE) 3102-14740-003 14740 517505 9-N1-1-368 435000. A4830-100 C1400-090 C1500-010 F1526-100 R0901-100 31021474000410136		BOND T E EVALUATION OF COMPONENTS AND SYSTEMS FOR HANDLING WASTE FROM HOUSED SWINE (ANIMAL WASTES LAGOONS POLLUTION) 3702-14740-002 14740 517810 30000. A4830-100 C3000-090 C3300-010 F1920-100 R0901-100 37021474000270106
	RHOODES R A MICROBIAL PROTEIN FROM LIQUID FRACTION OF FEEDLOT WASTES (ANIMAL-WASTE FERMENTATION FEED-SUPPLEMENTS BIOLOGICAL-OXYGEN-DEMAND) 3102-14740-004 14740 517607 9-N1-1-379 87000. A4830-100 C1400-090 C1500-010 F0790-100 R0901-100 31021474000510137		MCCALLA T M CHEMISTRY AND MICROBIOLOGY OF RUNOFF, SOIL PROFILE, AND GROUNDWATER FROM FEEDLOTS AND WASTE-DISPOSAL AREAS 3705-14740-001 14740 517610 50000. A4830-100 C0100-030 C0200-040 C6800-030 F0714-100 R0901-100 37051474000270140
	PRIGHAM, T G GERM PLASM BANK OF MICROORGANISMS FOR RESEARCH ON POLLUTION ABATEMENT AND WASTE DISPOSAL (YEASTS FUNGI MOLOS BACTERIA TAXONJMY FERMENTATION) 3102-14740-005 14740 517810 84000. A4830-100 C1400-050 C1500-010 C1790-040 F0710-100 R0901-100 34021474000140107		GILBERTSON C B WASTE MANAGEMENT IN HOUSED AND OUTDOOR BEEF AND SWINE FEEDLOTS 3705-14740-002 14740 517610 48300. A4830-100 C0100-020 C0200-060 C6800-020 F1920-100 R0901-100 37051474000370141
	MAYES H F IMPROVE METHODS EQUIPMENT AND FACILITIES FOR HANDLING WASTE		ELLIOTT L F VOLATILE CHEMICALS, MICROORGANISMS, AND OUST IN THE ENVIRONMENT OF INDOOR AND OUTDOOR CONFINED BEEF AND SWINE UNITS (DOORS AMINES SULFHYDRILS FATTY-ACIDS

Figure 3.—Research Activity ordered output produced by a KWOC index on level 3. Within the listing for a given keyword (14740 in this case) the entries are listed in card file order. The first entry is the RA entry. Note: Projects from five locations are contained in the listing itself. Every entry contains "14740" as a separate "word" on level 3.

DISCUSSION

These indexes have been an invaluable aid to PPR operations. By outputting on disk and printing twice on 4-part carbon paper, each PPR member and several others in the regional office have a desk copy available. These indexes have become

the primary information system used by PPR, because with them extracting project information is much easier in response to telephone and other inquiries.

Figures 1 through 8 illustrate the kinds of proi-

3502-10160-003	35021616000350115	IRRIGATION METHODS WATER AND FERTILITY REQUIREMENTS OF SOILS AND CROPS IN MINNESOTA 3505-12270-001 12270 517511 9-SWC-019-CMOR-8 83500. A4300-100 C0200-100 F1920-100 R0106-100
BARNES D K DEVELOPMENT OF HYBRID ALFALFA (GENETICS, MALE-STERILITY) 3502-16160-003 16160 517711 15700. A5000-100 C2000-100 F0512-100 R0307-100	3505-12310-001 HOLT R F CROP PRODUCTION IN THE CORN BELT (TILLAGE CORN SOYBEANS) 3505-12310-001 12310 517409 9-SWC-030-CMCR-3 108200. A4300-100 C0200-100 F2421-100 R0105-100	35051231000150122
3504 SEN O N ECOPHYSIOLOGY OF WEEDES ASSOCIATED WITH PEARL MILLET AND SESAME (HERBICIDE GROWTH-REGULATOR CROP-ECOLOGY WEED-COMPETITION ALLELOPATHY) 7-AA7-00000-425 517703 3504 7-FG-1001A-501 32035. A4700-100 C2500-050 C1800-050 F0212-100 R0209-100	A00021 00021 3505-12330-001 RADKE J K PLANT SOIL METEOROLOGICAL INTERACTIONS RELATED TO PLANT GROWTH IN THE CORN BELT (WHEATBREAKS CORN SOYBEANS) 3505-12330-001 12330 517509 9-SWC-032-CMOR-5 48400. A4300-100 C0200-100 F2420-100 R0105-100	35051233000150123
3504-15070-001 BLAISOEEL F W CANTILEVER OUTLET SCOUR HOLES AND PLUNGE POOLS (SPILLWAY CONDUITS STILLING-BASINS HYDRAULICS STRUCTURES CONSERVATION) 3504-15070-001 15070 517810 40000. A4300-100 C0300-100 F1926-100 R0107-100	35041507000150117 3505-14830-001 TIMMONS O R RELATION OF AGRICULTURAL PRACTICES AND NATURAL VEGETATION TO NUTRIENT CONTENT OF WATERS (POLLUTION RUNOFF FERTILIZER RESIDUES) 3505-14830-001 14830 517410 9-SWC-027-CMOR-4 6180. A4830-100 C0200-100 F1928-100 R0901-100	35051483000250125
3504-15070-002 ANDERSON C L HYDRAULICS AND SCOUR FOR THE CANTILEVERED CHUTE OUTLET (SPILLWAY CONDUITS STILLING-BASINS HYDRAULICS CONSERVATION STRUCTURES) 3504-15070-002 15070 517701 30000. A4300-100 C0300-100 F1926-100 R0107-100	3505-14830-002 YOUNG R A FIELD DETERMINATION OF NUTRIENTS AND SEDIMENT FROM NON-POINT SOURCES (WATERSHEDS NUTRIENT POLLUTION ACTMO) 3505-14830-002 14830 517610 42120. A4300-100 C0200-100 F1920-100 R0901-100	35051506000150126
3504-15070-003 BLAISOEEL F W INLETS FOR CLOSED CONDUIT SPILLWAY CONSERVATION STRUCTURES (HYDRAULICS) 3504-15070-003 15070 517601 40000. A4300-100 C0320-100 F1926-100 R0107-100	3505-15060-001 ONSTAD C A MECHANICS AND CONTROL OF SOIL EROSION BY WATER BARNES AND ASSOCIATED SOILS 3505-15060-001 15060 517409 9-SWC-016-CMOR-1 69100. A4300-100 C0300-050 C0100-050 F1920-100 R0107-100	35051600000250144
3504-15070-004 BLAISOEEL F W SCOUR AND PROTECTION AGAINST SCOUR AT CONSERVATION (SPILLWAYS STILLING-BASINS HYDRAULICS) 3504-15070-004 15070 517701 40000. A4300-100 C0320-100 F1926-100 R0107-100	3505-16000-002 VODRNEES W B TECHNIQUES FOR CONTROLLING SOIL COMPACTION AND IMPROVING ROOT GROWTH AND CROP YIELDS IN THE NORTHERN CORN BELT (WHEEL TRAFFIC ENVIRONMENT NUTRIENT UPTAKE TILLAGE) 45000. A4300-100 C0100-100 F2421-100 R0102-100	
3505-12270-001 DYLLA A S	35051227000150121	

Figure 4.—A location-ordered (Michigan-Minnesota-Wisconsin area) listing by a KWOC index of level 3. Area and location are identified by the first four digits of the project code, 3502 to 3505. The system ranks or alphabetizes keywords up to 20 characters.

INPS-LEWIS IMPROVED PLANT VARIETIES FOR FORAGE 16160 PE-22-610-2 BB-11 PES	2PAC-JANSEN 3TA3-GORZ 16160	2PAC-GOLUBIC INPS-GORTNER HUMAN REQUIREMENTS FOR CARBOHYDRATES AND ENERGY 15980 PE-44-646 BB-46 MNE	3TA3- 15950
INPS-LUNIN REDUCTION OF SALT DAMAGE TO CROPS SOILS AND WATERS 12290 PE-71-630-1 BB-30 SWA	2PAC-GRABLE 3TA3- 12290	INPS-HAYS NATURALLY OCCURRING TOXICANTS IN FOOD AND FEED 15960 PE-52-648 BB-48 MNE	3TA3- 15960
INPS-LUNIN LAND RECYCLING OF MUNICIPAL AND PROCESSING WASTES 14690 PE-71-676 BB-76 SWA	2PAC-GRABLE 3TA3-LARSON W E 14690	INPS-HAYS IDENTIFICATION CONTROL AND ELIMINATION OF MYCOTOXINS FROM AGRICULTURAL COMMODITIES 15970 PE-52-648 BB-48 MNE	3TA3- 15970
INPS-LUNIN CONTROL OR PREVENTION OF SOIL AND WATER POLLUTION FROM FERTILIZERS 14830 PE-71-676 BB-76 SWA	2PAC-GRABLE 3TA3-HOLT 14830	INPS-HAYS ELIMINATION OF SALMONELLA AND OTHER PATHOGENS FROM AGRICULTURAL PRODUCTS 15980 PE-52-648 BB-48 MNE	3TA3- 15980
INPS-LUNIN RECLAMATION AND REVEGETATION OF LAND AREAS DISTURBED BY MAN 16010 PE-71-630-1 BB-30 SWA	2PAC-GRABLE 3TA3-POWER 16010	INPS-GORTNER FAMILY USE OF RESOURCES 15990 PE-52-650 BB-50 MNE	3TA3- 15990
INPS-PALLANSCH PROCESSING TECHNOLOGIES FOR FRUITS AND VEGETABLES 15600 PE-25-617-1 BB-17 MNE	2PAC-GOLUBIC 3TA3- 15600	INPS-SENTI IMPROVED TECHNOLOGIES FOR MARKETING AND QUALITY MAINTENANCE OF CUT FLOWERS, NURSERY AND FLORAL PRODUCTS 16040 PE-71-661-1 BB-61 MNE	3TA3- 16040
INPS-RANEY TECHNIQUES FOR EFFICIENT WATER USE ON NONIRRIGATED CROP AND GRASS LANDS 12310 PE-71-630-1 BB-30 SWA	2PAC-GRABLE 3TA3-WILLIS 12310	INPS-PALLANSCH WASTE MANAGEMENT DURING FRUIT AND VEGETABLE PROCESSING 16050 PE-71-676 BB-76 MNE	3TA3- 16050
INPS-RANEY METHODS TO MAKE BENEFICIAL CHANGES IN ENERGY USE IN THE SOIL PLANT ATMOSPHERE CONTINUUM (SPAC) 12330 PE-71-630-1 BB-30 SWA	2PAC-GRABLE 3TA3-PETERS 12330	INPS-SCHULLER ALLEVATION OF POLLUTION BY USE OF PRODUCTS DERIVED FROM AGRICULTURAL SOURCES 16060 PE-71-676 BB-76 MNE	3TA3- 16060
INPS-REEVE EFFICIENT IRRIGATION AND AGRICULTURAL WATER 12270 PE-71-630-1 BB-30 SWA	2PAC-GRABLE 3TA3-DOERING 12270	2PAC-GRABLE INPS-BRAKENSIEK 3TA5-BOUWER RECHARGING GROUND WATER FOR AGRICULTURAL AND URBAN USES 12250 PE-71-630-1 BB-30 SWA	3TA3- 12250
INPS-REEVE IMPROVED DRAINAGE SYSTEMS FOR AGRICULTURAL LAND 12280 PE-71-630-1 BB-30 SWA	2PAC-GRABLE 3TA3-DOERING 12280	INPS-BRAKENSIEK INCREASING AND CONSERVING FARMWATER SUPPLIES 12260 PE-71-630-1 BB-30 SWA	3TA3- 12260
3TA3-POWER INPS-BARROWS MAINTENANCE OF SOIL FERTILITY BY USE OF FERTILIZERS CROP RESIDUES ANIMAL WASTES AND BETTER SOIL MANAGEMENT PRACTICES 12320 PE-71-630-1 BB-30 SWA	2PAC-GRABLE 3TA3-POWER 12320	INPS-REEVE EFFICIENT IRRIGATION AND AGRICULTURAL WATER 12270 PE-71-630-1 BB-30 SWA	3TA3-DOERING 12270
INPS-LUNIN RECLAMATION AND REVEGETATION OF LAND AREAS DISTURBED BY MAN 16010 PE-71-630-1 BB-30 SWA	2PAC-GRABLE 3TA3-POWER 16010	INPS-REEVE IMPROVED DRAINAGE SYSTEMS FOR AGRICULTURAL LAND 12280 PE-71-630-1 BB-30 SWA	3TA3-DOERING 12280
3TA3-ROWELL INPS-ENNIS 3TA4-ENDO BIOLOGY OF PLANT DISEASES AND NEMATODES AFFECTING CROPS 12060 PE-22-610-4 BB-11 PES	2PAC-JANSEN 3TA3-ROWELL 12060	INPS-LUNIN REDUCTION OF SALT DAMAGE TO CROPS SOILS AND WATERS 12290 PE-71-630-1 BB-30 SWA	3TA3- 12290
3TA3-SKROLA INPS-JONES NEW CROPS 15150 PE-71-661-1 BB-71 PES	2PAC-JANSEN 3TA5-DIETZ 3TA7-LANGFORD 15580	INPS-RANEY TECHNIQUES FOR EFFICIENT WATER USE ON NONIRRIGATED CROP AND GRASS LANDS 12310 PE-71-630-1 BB-30 SWA	3TA3-WILLIS 12310
INPS-JONES 3TA1-WHITE INTRODUCTION AND MAINTENANCE OF GERM PLASM 15580 PE-22-610-4 BB-11 PES	2PAC-JANSEN 3TA3-SKROLA 3TA7-LANGFORD 15590	INPS-REEVE IMPROVED DRAINAGE SYSTEMS FOR AGRICULTURAL LAND 12280 PE-71-630-1 BB-30 SWA	3TA3-DOERING 12280
INPS-LEWIS INCREASE OF GERM PLASM RESOURCES IN WINTER NURSERY 15590 PE-22-610-4 BB-11 PES	2PAC-JANSEN 3TA2-SKROLA 15590	INPS-REEVE IMPROVED DRAINAGE SYSTEMS FOR AGRICULTURAL LAND 12280 PE-71-630-1 BB-30 SWA	3TA3-DOERING 12280
3TA3-SJOERHOLM INPS-ALTMAN ELECTRIC EQUIPMENT TO IMPROVE SEED GERMINATION AND PLANT GROWTH 12180 PE-22-610-4 BB-11 MNE	2PAC-BLACK 3TA3-SJOERHOLM 12180	INPS-REEVE IMPROVED DRAINAGE SYSTEMS FOR AGRICULTURAL LAND 12280 PE-71-630-1 BB-30 SWA	3TA3-DOERING 12280

Figure 5.—Indexing of Research Activities by (a) National Program Staff Coordinator, (b) Program Analysis and Coordination Staff analyst, (c) Technical Advisors (note that TA's for all regions are included), and (d) ARS sciences area (SWA refers to the Soil, Water and Air sciences). Coding of selected information was employed to separate certain kinds of similar data contained on the same input level. In the illustrations included here the prefixes INPS-, 2PAC, and 3TA3- were used to insure that all NPS, PAC, and TA names appeared together. Additionally, a number was added to the TA code to signify the region, for example, 3TA3- signifies a TA in the North Central Region.

ect indexes TRIAL assemblies. A brief explanation of the index is included in the figure caption. In most instances the index's application will be obvious.

Project indexes have found many uses in addition to those illustrated in figures 1-8. For example, they have been useful for manually assembling linking-data information between project and budgeting functions (ARS Form 387). Also, indexing on the project classification data promises to become increasingly useful. TRIAL's searching capabilities, not illustrated here, which scans each entry for the existence of keywords either alone or

in combination with other keywords, could be used to search either on- or off-line.

Using an existing project-handling system does, of course, require that the application follow the format of that system. But the TRIAL system goes a long way in meeting PPR project information needs at a fraction of the cost of a customized project-handling system.

Other data bases have been formatted for the computerized indexing system. One that promises to be particularly useful is a file of North Central Regional Committee titles, representatives, and related information. Indexes similar to those illustrated herein will be obtained for this data base.

(LUEODERS V O) OUCIOS L A IMPROVED RESISTANCE TO SOYBEAN CYST NEMATODE (GERM PLASM BREEDING PHYTOPHORA) 6-0610-01-49-CA-A22850 577406 3402 6CAS-11337 M1-UNIV	(LUEODERS V O) A22850	22850	32021175000220139
(MALMOUIST W A) LANK R B INVESTIGATIONS ON EQUINE INFECTIOUS ANEMIA (HORSES VIROLOGY ANIMAL-DISEASES) 3202-11750-002A 11750 517801 3202-9068 LA-LSV 6CAS-9068 (MALMOUIST W A) 32021175000320140	A22828	22828	32021175000420162
MOORE R W DIAGNOSIS OF EQUINE INFECTIOUS ANEMIA 3202-11750-003A 11750 517801 3202 6CAS-9081 TX-AFM-UNIV			
HENSON J B DIAGNOSIS AND PATHOGENESIS OF EQUINE INFECTIOUS ANEMIA (HORSES ANIMAL-VIRUSES ANTIBODIES IMMUNITY VIROLOGY IMMUNOGLOBULIN SEROLOGY IMMUNE-RESPONSE ONCOGENIC VACCINES MACROPHAGES CHARACTERIZATION) 3202-11750-004A 11750 517901 3202 6CAS-9067 WASH-SUNIV			
(MANGLITZ G R) PASS B C PEST MANAGEMENT OF ALFALFA PESTS 6-ENTC08395-A22828 517406 KY-AES 3705 6GRT-9978 A22852 22852			
HANWAY O G PEST MANAGEMENT OF ALFALFA PESTS IN NEBRASKA 6-ENTC0841CA-A22852 517501 18-AES 3705 6CAS-11238-NE-UNIV			
(MARKS E P) BORG T K BIOCHEMICAL AND CYTOCHEMICAL INVESTIGATIONS OF INSECT NEUROSECRETION IN VITRO (ORTHOPTERA LEPIDOPTERA) 3090-12151-001A 12150 517506 3602 NO-FARGO 6CAS-213			
a			
3090-12151-002A BORG T K SYNTHESIS AND TRANSPORT OF RADIO-LABELED NEUROHORMONES IN VIT 3090-12151-002A 12151 517506 3602 6CAS-213 NO-NDU 0. A4900-100 C6500-100 F0414-100 R0318-100	309012151002E0048	22850	32021175000420162
3090-13311-001A MILLS R B ACCLIMATION EFFECTS OF WINTER GRAIN TEMPERATURES ON INSECTS COMMONLY INFESTING STORED WHEAT IN KANSAS 3090-13311-001A 13310 517612 3707 KS-AES 6CAS-228 25000. A5800-100 C1799-100 F0412-100 R0408-100	309013311001E0030	22850	32021175000420162
3090-13661-001C GURAKHPURWALLA H D (WATSON C A) DEVELOPMENT OF A SYSTEM FOR DETERMINING MOISTURE CONTENT OF GRAINS USING MICROWAVE ENERGY 3090-13661-001C 13660 517509 3707 TX-AI 6CON-1 29772. A5800-100 C1400-070 C1500-030 F1925-100 R0501-100	309013661001E0031	22850	32021175000420162
3090-14691-001A MARTIN W P DEVELOPMENT AND INSTRUMENTATION OF A WATER MANAGEMENT SYSTEM FOR THE APPLICATION OF SEWAGE SLUDGE TO LAND (CONSERVATION TERRACES POLLUTION) 3090-14691-001A 14690 517506 3502 6CAS-208 MN-UNIV 35000. A4830-100 C0100-050 C0200-050 F2421-050 F1528-050 R0301-100	309014691001E0032	22850	32021175000420162
b			
7-FG-INDIA-468 ISRAEL P BIOLOGICAL CONTROL OF RICE STEM BORERS IN INDIA (INSECTS) 7-8-A7-ENT-71-A22885 517503 3402 7-FG-INDIA-468 43672.	A22885	22885	32021175000420162
7-FG-INDIA-478 RAO T N FERMENTATIVE PRODUCTION OF TEMPEH AND ONT-JUM TYPE FOODS FROM SOYBEANS FOR USE IN INDIA 7-8-UR-A7-40-207-A22828 517502 3102 7-FG-INDIA-478 38731.	A22828	22828	32021175000420162
7-FG-INDIA-490 NATH V EFFECT OF CALCIUM CHLORIDE ON THE GONADS OF LUCUSTA-MISRAURIE (INSECT) 7-8-A7-ENT-111-A22885 517505 3102 7-FG-INDIA-490 18052.	A22885	22885	32021175000420162
7-FG-INDIA-491 KAMAKRISHNAN C V INDIAN FERMENTED FOODS FROM US SOYBEANS 7-8-UR-A7-40-248-A22977 517703 3102 7-FG-INDIA-491 51153.	A22977	22977	32021175000420162
7-FG-INDIA-498 OSMAN S H OILS FROM NATIVE INDIAN PLANT SEEDS (NEW-CROPS INDUSTRIAL-PRODUCTS OILSEEDS COMPOSITION LIPIOS-ANALYSIS BOTANICAL EXPLORATION COLLECTING TAXONOMY) 7-UR-A7-40-186 517705 3102 7-FG-INDIA-498 37055.	A00122	00122	32021175000420162
7-FG-INDIA-501 SEN O N ECOPHYSIOLOGY OF WEEDS ASSOCIATED WITH PEARL MILLET AND SESAME (HERBICIDE GROWTH-REGULATOR CROP-ECOLOGY WEE-COMPETITION ALLELOPATHY) 7-AAT-00000-425 517703 3504 7-FG-INDIA-501 32035.	A00021	00021	32021175000420162
7-FG-INDIA-526 GHANNA PROTEIN SYNTHESIS BY CHLOROPLASTS AND ITS BIOLOGICAL CONTROL 7-8-A7-CR-376-A40006 517707 3311 7-FG-INDIA-526 39305.	A40006	40006	32021175000420162
c			
3090-10613-004A C O. SOYBEAN ARTHROPODS IN DELAYED-PLANTING CULTURE 3090-10613-004A 10613 517705 3302 6CAS-287 IN-PURDUE 0.	A4500-100 C2300-100 F0412-100 R0207-100	22850	32021175000420162
6CAS-10907 KRAVINUS M G ECOLOGICAL RESEARCH ON THE LESSER PEACH TREE BORER 6-ENT80826CA-A22492 517406 3303 WI-UNIV 6CAS-10907 8000.	A4500 C1000 F0412 R0204	22492	32021175000420162
6CAS-10927 KRAVINUS M G ECOLOGICAL RESEARCH ON THE LESSER PEACH TREE BORER 6-ENT80826CA-A22750 517406 WI-UNIV 3303 6CAS-10907 15000.	A4500 C1000 F0412 R0204	22750	32021175000420162
6CAS-10929 MOSS O N MAXIMIZING PHOTOSYNTHESIS IN WHEAT AND BARLEY 6-0160-03052CA-A22331 517506 MN-UNIV 3608 6CAS-10929 47250.	A5000 C1800 C1700 F0512 F1312	22331	32021175000420162
6CAS-10940 CURTIS S E EFFECT OF ATMOSPHERIC GASES ON PHYSIOLOGY FUNCTION AND PRODUCTION PERFORMANCE OF SWINE 6-3-074-214-14-046 517406 IL-UNIV 6CAS-10940 BELTS 28000.	A4830 C3200 F0210 F0910 F1310	22200	32021175000420162
6CAS-11176 THOMPSON T L TEMPORARY STORAGE AND CONDITIONING OF HIGH MOISTURE FEED GRAINS 6-308-048-C605-CA 4000.	A5200 C1400 C1500 F1920 R0308	22684	32021175000420162
d			

Figure 6.—Extramural project listings by (a) ADODR—shown in parenthesis, (b) project number, (c) the location where the extramural research is being conducted, and (d) the agreement number. The 6CAS prefix was used to keep this component separate from the regular project listing and signifies cooperative agreement—specific.

7-FG-INDIA-468 ISRAEL P BIOLOGICAL CONTROL OF RICE STEM BORERS IN INDIA (INSECTS) 7-8-A7-ENT-71-A22885 517503 3402 7-FG-INDIA-468 43672.	A22885 PAOMANASHAN S Y (IGNOFFO G C M) F0412 R0207	22885	
7-FG-INDIA-478 KALIA N FERMENTATIVE PRODUCTION OF TEMPEH- AND ONT-JUM TYPE FOODS FROM SOYBEANS FOR USE IN INDIA 7-8-UR-A7-40-207-A22828 517502 3102 7-FG-INDIA-478 38731.	A22828 (WANG H L) F0112 F0910 R0406	22628	
7-FG-INDIA-490 NATH V EFFECT OF CALCIUM CHLORIDE ON THE GONADS OF LUCUSTA-MISRAURIE (INSECT) 7-8-A7-ENT-117-A22885 517505 3102 7-FG-INDIA-490 18052.	A22885 (GASSNER G) F0412 R0318	22885	
7-FG-INDIA-491 KAMAKRISHNAN C V (HESSLETINE C W) INDIAN FERMENTED FOODS FROM US SOYBEANS 7-8-UR-A7-40-248-A22977 517703 3102 7-FG-INDIA-491 51153.	A22977 (HESSLETINE C W) F0910 R0406	22977	
7-FG-INDIA-498 OSMAN S H OILS FROM NATIVE INDIAN PLANT SEEDS (NEW-CROPS INDUSTRIAL-PRODUCTS OILSEEDS COMPOSITION LIPIOS-ANALYSIS BOTANICAL EXPLORATION COLLECTING TAXONOMY) 7-UR-A7-40-186 517705 3102 7-FG-INDIA-498 37055.	A00122 (EARLE F R) F0212-040 F1524-060 R0407-100	00122	
7-FG-INDIA-501 SEN O N ECOPHYSIOLOGY OF WEEDS ASSOCIATED WITH PEARL MILLET AND SESAME (HERBICIDE GROWTH-REGULATOR CROP-ECOLOGY WEE-COMPETITION ALLELOPATHY) 7-AA7-00000-425 517703 3504 7-FG-INDIA-501 32035.	A00021 (ANDERSEN R N) F0212-050 F0412-100 R0209-100	00021	
7-FG-INDIA-526 GHANNA A PROTEIN SYNTHESIS BY CHLOROPLASTS AND ITS BIOLOGICAL CONTROL 7-8-A7-CR-376-A40006 517707 3311 7-FG-INDIA-526 39305.	A40006 (WILSON C A) F0112 R0318	40006	
517509 PERRY T W CATTLE FEEDING TESTS OF CRAMBE MEAL AS A PROTEIN CONCENTRATE (TOXINS, GLUCOSINOLASE, THIOLGLUCOSIDE, EPI-PROGOSTRIN) 3102-15960-003A 15960 517509 IN-PURDUE 6CAS-202 8000.	A4980-100 C2500-100 F1524-100 R0702-100 34081570000240129		31021596000310123
KLINE G L IMPROVED METHODS AND EQUIPMENT FOR GRAIN HARVESTING DRYING CONDITIONING AND STORAGE ON FARMS (CORN) 3408-15700-002 15700 517509 9-308-048-0603 33200.	A5200-100 C1400-100 F1920-100 R0308-100 34081570000340130		
KLINE G L PRINCIPLES OF GRAIN DRYING (CORN) 3408-15700-003 15700 517509 9-308-048-0601 24900.	A5200-100 C1400-100 F1920-100 R0308-100 35051233000150123		
RAOKE J K PLANT SOIL METEOROLOGICAL INTERACTIONS RELATED TO PLANT GROWTH IN THE CORN BELT (WINDBREAKS CORN SOYBEANS) 3505-12330-001 12330 517509 9-SWC-032-CMOR-5 48400.	A4300-100 C0200-100 F2420-100 R0105-100 35081116000750158		
WITTER R L EPIZOOTIOLOGY OF TURKEY HERPESVIRUS (HVT) IN TURKEYS (VIRUS POULTRY TURKEYS TUMORS ANTIGENS) 3508-11160-007 11160 517509 9-29-001-211-23-122 TERMINATED*****	A4600-100 C2950-100 F0610-030 F1110-020 F1410-050 R0211-100 309013661001E0031		
GURAKHPURWALLA H D (WATSON C A) DEVELOPMENT OF A SYSTEM FOR DETERMINING MOISTURE CONTENT OF GRAINS USING MICROWAVE ENERGY 3090-13661-001C 13660 517509 3707 TX-AI 6CON-1 29772.	A5800-100 C1400-070 C1500-030 F1925-100 R0501-100		

Figure 7.—Portion of PL 480 project listing (the 7 is used to achieve a separation similar to that described in figure 6).

Figure 8.—Termination date listing. The 5T brings all terminations together in one section. It is followed with the year and month.

APPENDIX

TRIAL Input Data Format and Control Instructions. This appendix provides more detailed information about input data format and the TRIAL system control statements, and illustrates the relative simplicity of the TRIAL system.

TRIAL input format uses 60 characters of free-field data per line, a one-character numeric identifier of the level of record definition in column 75, and 19 characters of optional reference code in columns 61-72 and 76-80. Input may be any alphanumeric character; the only restriction is that

a line (card) may not begin with an asterisk.

Input format for the two types of entries contained in the data file (CRIS Work Unit and Research Activities) were slightly different. An example of the data cards for a CWU entry is shown in figure 9. The optional reference code contained in columns 61-72, identifies the physical location of the project in the PPR file, and the entry in columns 76-80 gives the location of the entry in the data deck. The section entitled File Structure on page 2 discusses the assignment of project

```
* $$ JOB USDATRO2,,,F2      )
.                             )
.                             )   Computer system control cards
.                             )   varies with computer used.
.                             )
.                             )
.                             )
/// EXEC TRIAL04,SIZE 300K    )

*EDIT                         )
NEW MASTER=11,NOMAP.         )
*DATA                         )
*INSERT                       )   Edit phase of TRIAL. Reads data
.                             )   file and place on tape for
.                             )   subsequent processing
      (data cards)           )
.                             )
.                             )
*END                          )

*INDEX                        )
*WORDS,TITLE,CARDS(2),STOP.  )
A,AND,AT, (Stooword list)    )   KWIC Index of Titles and
*KWIC,TITLE,CARDS(2).        )   Keywords (Level 2)
*END                          )
*PRINT                        )
OK.                           )
*END                          )

*INDEX                        )
*WORDS, PROJNO, CARDS(3), NULL. )
*KWOC, PROJNO, CARDS(0,1,2,3,4). )   KWOC Index on Project Number
*END                          )   Level (3)
*PRINT                        )
OK.                           )
*END                          )

*INDEX                        )
*WORDS, SCIENTISTS, CARDS(1), NULL. )
*KWOC, SCIENTISTS, CARDS(0,1,2,3). )   KWOC on Scientists--Level 1.
*END                          )
*PRINT                        )
OK.                           )
*END                          )

*FINI                         )   TRIAL End of Job Card

/*                             )
/&                             )   Local system control cards
* $$ EOJ                      )
```

Figure 10.—List of computing system control cards and TRIAL edit and index instructions that were used to perform the indexes illustrated in figures 1 to 8.

data to TRIAL file structure. **Note:** Because the indexes are reproductions of the information on the data cards, additional examples of data input can be inferred by examining the indexes.

In designing the data format, certain kinds of information were coded to separate it from the general contents of the index. For example, NPS coordinators, PACS analysts, and TA's were entered with a 1NPS-, 2PAC-, or 3TA3- preceding the name. This coding caused the indexing routine to separate these from other portions of the investigator (or name) index. (See figs. 5a, 5b, and 5c.) Codings were also used for termination dates, agreement numbers, and similar data.

After the data cards for all the entries (projects) were punched, they were assembled into a data file or deck. The order of the data deck affects the order of the resulting indexes; for example, within a listing for a given term or keyword, entries are listed in the same order that they occur in the data deck. By inserting the Research Activity data file at the beginning of the data deck, the first entry of many listings was the RA under which all the projects in that listing were conducted (see fig. 3).

After the data file was assembled, appropriate system interface cards and TRIAL system cards were added to the front and rear of the data deck, and the entire deck submitted to the computing center. The system interface cards are a function of the computer center's operating system, but the user has freedom to choose the required TRIAL system cards to effect the desired index.

A listing of the system and TRIAL control instructions (cards) is shown in figure 10. Computing system control cards contain billing data and allocate appropriate tape and disk units to the job. They occur primarily at the beginning of the total job data deck; however, the last three cards (lines) shown in figure 10 are also system control cards to end the job.

All TRIAL control cards, except one in the printing routine specified by OK., begin with an asterisk (*).

The EDIT phase (beginning with *EDIT) reads the project file data cards on to a master magnetic tape where it is subsequently used for indexing and searching. The master tape can be retained and the EDIT routine for subsequent runs can then add, delete, or correct the data file. However, maintaining the card file and recreating the master tape for each run has been more convenient.

Keyword-out-of-context (KWOC) indexes are lists

of entries under a keyword that is separate from the list itself. The TRIAL system instructions (cards) to perform KWOC indexes of project numbers (level 3) and project scientists (level 1) are shown in figure 10. These instructions bring the indexing routine into operation, and describe what levels are to be searched (levels 3 and 1), the nature of the index, the levels of information to be carried to the printer, and the format of the printed output. The indexes illustrated in figures 2 through 8 were all produced with the two sets of KWOC instructions discussed here.

Keyword-in-context (KWIC) indexes are lists of projects with the keyword shown in the context that it was used. KWIC indexing is particularly significant on the title and keyword levels, for example, level 2. The TRIAL system control cards to accomplish a KWIC index are shown near the center of figure 10.

A stopword list and the *KWIC are the only instructions distinctly different from the KWOC controls. The stopword list is merely a list of words that are trivial for retrieval purposes. For example, this feature avoided listing the word "of" 1082 times in the KWIC index of 1435 projects similar to those in figure 1.

The user has extensive control of keywords; that is, the more stopwords used the more discriminating will be the index. However, we have taken a rather conservative view toward using stopwords. If a word has any probability of being useful for reference, we do not enter it on the stopword list. Obviously, each run locates new stopwords, but the only practical way to compile them is to first run the index and then add new stopwords to the list for subsequent runs.

TRIAL provides considerable flexibility in printing options. However, the standard output, specified by the OK. in figure 10 and illustrated throughout this text, has been satisfactory. For further information on the various indexing, searching, and printing options, the reader is referred to TRIAL User's Manuals.^{6 7}

⁶Borman, Lorrain and Donald Dillaman. 1968. TRIAL: An information retrieval system for creating, maintaining, indexing, and retrieving from files of textual information. CDC user's manual. Vogelback Computing Center, Northwestern University, Evanston, Ill.

⁷Borman, Lorrain and Donald G. Dillaman. 1971. TRIAL: An informational retrieval system for creating, maintaining, indexing and retrieving from files of textual information. TRIAL IBM 360 user's manual. Vogelback Computing Center, Northwestern University, Evanston, Ill.

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